

# 3

Treatment Manual

## Nonchemical Treatments

### *Cold Treatment (CT)*

#### Contents

Intransit Cold Treatment Procedure of Ships: Introduction	page-3-7-1
Intransit Cold Treatment Procedure of Ships: Introduction	page-3-7-1
Performance Survey of Vessels for Approval	page-3-7-2
Meeting With Ship's Officers	page-3-7-2
Operation Check of Temperature Recording Instrument	page-3-7-3
Identification Check of Temperature Sensors	page-3-7-3
Calibration Check of Temperature Sensors	page-3-7-4
Survey of Refrigerated Compartments	page-3-7-5
Reporting	page-3-7-5
Initiating Intransit Cold Treatments	page-3-7-6
Conventional Refrigerated Vessel	page-3-7-6
Container Vessel	page-3-7-8
Fruit in Shipboard-Cooled Containers	page-3-7-9
Clearance of Shipments Cold Treated in Transit	page-3-7-10
Conventional Vessel	page-3-7-10
	page-3-7-15
Progressive Cold Treatment Clearance	page-3-7-16
Intransit Cold Treatment Procedure—Self-Refrigerated (Integral) Containers:	
Introduction	page-3-7-16
Intransit Cold Treatment Procedure—Self-Refrigerated (Integral) Containers:	
Introduction	page-3-7-16
Initiating Intransit Cold Treatments	page-3-7-17
Check Container	page-3-7-17
Calibration of Temperature Recorders and Sensors	page-3-7-17
Check Fruit	page-3-7-17
Loading the Fruit	page-3-7-18
Monitor Loading and Placement of Temperature Sensors	page-3-7-18
Prepare Documents	page-3-7-19
Distribute Documents	page-3-7-19
Clearance of Intransit Cold Treatments	page-3-7-20
Cold Treatment—Warehouses	page-3-7-21
Initiating the Cold Treatment	page-3-7-22
Clearance of the Cold Treated Fruit	page-3-7-22

#### Intransit Cold Treatment Procedure of Ships: Introduction

The use of sustained cold temperatures as a means of insect control has been employed for many years. Rigid adherence to specified temperatures and time periods effectively eliminates certain insect infestations. Treatments may be conducted in refrigerated compartments of transporting vessels or in containers cooled by the ship's refrigeration system or by individually refrigerated containers.

Owners of vessels seeking approval to conduct intransit CT should apply in writing to:

Oxford Plant Protection Laboratory (OPPS)  
United States Department of Agriculture (USDA)  
Animal and Plant Health Inspection Service (APHIS)  
Plant Protection and Quarantine (PPQ)  
901 Hillsboro Street  
Oxford, NC 27565

The vessels and/or containers must be capable of maintaining fruit pulp temperatures within the specified CT schedules. To monitor these treatments, the vessels and/or containers must be equipped with a temperature recording device which meets the approval of PPQ. Specifications for temperature recording installations and other requirements for approval are supplied upon request (see Certifying Facilities, Cold Treatment (CT)).

PPQ officers conduct vessel and/or container approval tests under the general guidance of OPPS. The Center will provide the officers with the necessary information for the testing of specific vessels and/or containers. The information will include plans of the refrigerated compartments with the number and location of the temperature sensors and other data as may be required.

The vessel must be docked prior to testing. Also, vessel's hold must be empty before it can be tested and certified by PPQ. Vessel approval tests can be performed at ports in the United States or most overseas ports. Fifteen working days, excluding weekends and holidays, will be required for PPQ to make travel arrangements to overseas ports.

Prior to the approval tests, a representative of the instrument company should have checked the temperature recorders. This representative should be available during the test to advise on the operation of the instrument and to correct deficiencies.

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## Performance Survey of Vessels for Approval

### Meeting With Ship's Officers

The ship's officers in most instances will have received instructions on the Agency's requirements from their owners. However, a discussion by the PPQ officer with these officers will provide for better understanding and cooperation. The discussion should include procedures used for the approval survey and the general treatment procedures in accordance with Quarantine 56 (7CFR 319.56-2d). A

communication system should be made available to facilitate communication between personnel in the compartments and the recording room.

### Operation Check of Temperature Recording Instrument

#### Strip Chart Recorder

The instrument should be in operation for at least 30 minutes prior to the calibration test. During this time a check should be made of the print interval, the chart speed, the print wheel, and the indicating wheel.

The print interval is determined by measuring the time lapse between each printing on the chart using the second hand of a watch.

The chart speed can be measured by noting the distance the chart advances in 1 hour or can be determined by using the print interval and the number of prints per inch or centimeter of chart. (For sequence of clearance procedure, see Clearance of Shipments Cold Treated in Transit, Conventional Vessel.)

The print wheel should be checked for the proper symbols and calibration point. The indicating wheel must correspond with the symbol on the print wheel. The printing on the temperature chart must be fully legible.

#### Data Logger

The instrument should be in operation for at least 30 minutes prior to calibration tests. During this time the functioning of the visual scanner, the printer, and the high limit setting should be observed. The log sheets should be checked for proper format and serialization.



Data logger installations are utilized to record various components of the vessel's operating systems. Temperature recording is only a part of the record which is produced. Under our approval requirements, the log sheets upon which the intransit cold treatment is recorded are generally more detailed in design than the standard commercial log sheet. They are prepared and serialized to facilitate scanning and to provide a level of security against fraudulent records. The USDA log should be printed on separate sheets with no other ship data interspersed. Data loggers are programmed to print out those temperatures above a set limit in a contrasting color. Some instruments print a symbol to indicate this. The limit is set at the time of loading to a temperature level which coincides with the projected treatment schedule.

### Identification Check of Temperature Sensors

#### Conventional Vessels

Individual sensors must be checked to verify that they are properly labeled and correctly connected to the temperature recorder. This may be accomplished by hand warming each sensor when its number appears on the indicating wheel or visual display panel of the recording instrument. A temperature change, which can be observed

at the instrument, should occur. If the instrument fails to react, the sensor is incorrectly connected or the print wheel is out of sequence. Correction by the instrument representative will be required.

## Container Vessels

To determine if the cables are correctly labeled as to position, resistor plugs of specified sequential values (e.g., 29.5 °, 30.0 °, 30.5 °, 31. °F) are coupled to the cables. The temperature value assigned to each cable should register on the temperature chart in the proper sequential order.

## Calibration Check of Temperature Sensors

## Conventional Vessels

Compartment temperatures are to be lowered to near 0 °C (32 °F), for the calibration tests. This requirement may be waived if insulated containers (i.e., styrofoam) are provided for the ice/water test standard.



It is APHIS policy to use the standard "rounding rule" to deal with this issue. In determining calibration factors, if the reading is .05 or higher, then round to the next higher number in tenths. If it is .04 or lower, then go to the lower number. For example: If the calibration factor was .15, then round to .2. If it was .32, then round to .3. Similar rounding can be used in actual treatment readings. If an actual reading was 34.04, then round to 34.0, then add or subtract the calibration factor, if necessary. If it was 34.07, then round to 34.1, then add or subtract the calibration factor, if necessary.

The following is the process for developing ice/water standards:

- ◆ A mixture of ice and fresh water is prepared in clean containers. The ice must be crushed and completely fill the container. Just enough water should be added to stir the mixture. The percentage of ice is estimated at 80-85 percent while the water fills the air voids (15-20 percent). As the ice melts, additional ice is added to the water level is reduced. The ice water mixture must be carefully prepared and stirred to maintain a temperature of 32F °.
- ◆ The sensors must be submerged in the ice water mixture without touching the sides or bottom of the container on each side.
- ◆ The mixture must be constantly stirred during the entire testing process.
- ◆ Testing of each sensor in the ice water continues until the reading is stabilized at the lowest temperature obtainable. Two consecutive readings of the lowest temperature obtainable must be recorded on the temperature chart or log sheet before calibrations are certified. There should be at least a 60 second interval between two consecutive readings for any one sensor; however, the interval should not exceed 5 minutes. Also, the recorder used with the sensors must be capable of printing on demand and not just at hourly intervals.

## Container Vessels

- ◆ Any sensor which reads more than plus or minus 0.3 °C (0.5 °F), from the standard 0 °C (32 °F) must either be corrected by calibration adjustments or replaced.
- ◆ Every effort should be made to determine the calibrations to the nearest tenth of one degree.

In contrast to conventional vessels, the temperature sensors are not a permanent part of the temperature recording equipment aboard the container vessel. They are fitted with a connector and are calibrated using shoreside facilities equivalent to the recording equipment aboard the vessel. The temperature recorder is equipped with cables which terminate in the ship's hold. The ends of these cables are fitted with a connector to which the temperature sensors are coupled when the container is positioned in the hold.

To calibrate the temperature recorder, a resistor plug, equivalent to a 0 °C (32 °F) reading, is coupled to the cable end. The calibration error for each cable will be noted on the temperature chart in the same manner as the standard ice water test.

### Survey of Refrigerated Compartments

An examination of each empty compartment should be conducted to determine its condition. Obvious faults, such as damaged doors or bulkheads, should be reported. For new constructions, details of the general layout of the compartments and their air distribution scheme should also be reported.

The sensors and storage compartments for conventional vessels and the sensor connectors for container vessels should also be checked to determine if they have been numbered according to the approved diagram for USDA sensors.

### Reporting

Complete details of the testing of the recording equipment and temperature sensors should be reported on PPQ Form 449 and forwarded to the following address:

USDA-APHIS-PPQ-CPHST  
Treatment Support & Certification  
1017 Main Campus Drive, Suite 2500  
Raleigh, NC 27606

The temperature charts or log sheets which contain the results of the calibration checks should be attached.

In the event there are circumstances or pertinent facts which are noteworthy but which cannot be included on the reporting form, a narrative report listing such information should be submitted with the PPQ Form 449.

General results of the test may be made known to the responsible ship's officers and representatives of the shipping line or instrument company. After review by CPHST, a certificate of approval, valid for a 3-year period, will be issued. The address of the party to which the certificate is to be sent should be included in the narrative report or on PPQ Form 449.

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## Initiating Intransit Cold Treatments

### Conventional Refrigerated Vessel

The PPQ officer boards the vessel to discuss calibration tests, refrigeration requirements, and loading and discharge procedures with the responsible ship's officers. Inspection and calibration of the temperature recording system follow. All materials and labor for this activity, except the calibration thermometer, should be supplied by the vessel or vessel's agent. The officer acts in a supervisory capacity, advising on proper procedure. As loading commences the officer must take fruit temperature readings, advise on proper stowage, and place temperature sensors into the fruit at appropriate intervals and locations. When loading operations are completed, the appropriate documents should be distributed as required.



In countries with which USDA-APHIS has a cooperative agreement, these activities can be conducted by qualified officials from that country. Contact the Preclearance Program Office in Riverdale, MD, for a list of qualified officials.

### Meet With the Ship's Officers

On most vessels approved for intransit cold treatment the ship's officers will have had some instructions from their owners, regarding requirements. However, a personal discussion with these officers will provide for better understanding and cooperation. Such a discussion should include (1) temperature sensor and instrument calibration testing (for which the vessel or vessel's agent must supply a mixture of fresh water and ice in clean containers), (2) stowage arrangement, and (3) treatment conditions. When loading is completed, the form letter of instruction listing the treatment schedule must be issued to the captain, along with the appropriate documents for presentation to the clearance official at the port of destination.

### Check Instrument Operation

**Strip Chart Recorder.** Prior to any testing, a full-length chart should be installed by ship personnel so that all the required information will be part of a continuous record. The instrument should be in operation for a period of at least one-half hour prior to calibration tests. During this time, a check is made of the chart speed and print interval. The printing must be legible. The ink pads should be freshly inked and print wheels clean.

**Data Logger.** A sufficient supply of log sheets must be available to provide a continuous record of calibration and treatment temperatures. The data logging system should be in operation at least one-half hour prior to the calibration tests. During this time a completed log sheet printout should be examined. The temperature set-point for an alarm printout should be activated to verify that this function is operational.

**Calibrate  
Temperature  
Recording  
System**

Only the compartments that will be carrying fruit under USDA-APHIS regulations should be calibrated. Refer to Intransit Cold Treatments, Performance Survey of Vessels for Approval (Operation Check of Temperature Recording Instrument, Identification Check of Temperature Sensors, and Calibrate Check of Temperature Sensors) for complete instructions on calibration.

**Monitor Loading  
and Placement  
of Temperature  
Sensors**

Experience with intransit cold treatments shows that the fruit should be precooled before loading which enables the fruit to reach the treatment temperature sooner. When precooled fruit is loaded, manual fruit pulp temperatures should be taken to insure temperature uniformity. If warm fruit is to be loaded in the same compartment as precooled fruit, it should be identified so that a sensor can be inserted in this fruit.

Sensors are to be placed throughout the load in locations representing all areas of the compartment and from midway to the top of the load. When more than two pulp sensors are available, one sensor should be placed in the fruit carton nearest the air-sensor which is located furthest from the cooler room.

If possible, the cartons in which the sensors will be located must be opened and the sensor inserted well into the fruit. The tip of the sensor must not extend beyond the fruit. In the case of small fruit, two or more fruit should be used. The cartons are to be properly closed following insertion of the sensors. If the fruit is palletized, it is sometimes necessary to insert the sensor into the fruit from the side of the carton. The pallet should be securely stowed to prevent shifting and possible damage to the sensor.

**Confirm  
Completion of  
Loading**

When the loading is completed, the compartments are to be secured. This information should be noted on the temperature chart or log sheet by recording the date and time of completion of each compartment and the officer's signature. Fruit is not to be added to the compartment after this has been completed.

**Prepare  
Documents**

A "Calibration of Temperature Sensors" record will be issued for each shipment. It must show the temperature readings as taken from the temperature chart or log sheet during the calibration testing. Readings should be given to the nearest tenth of one degree. When the loading of

each compartment has been completed, the temperature reading of each fruit probe should be obtained from the temperature recorder and recorded on this form.

A "Location of Temperature Sensors" record will be prepared showing the actual position of each fruit temperature sensor. (See sample form in Appendix A.) This can be done either by a written description or by a diagrammatic sketch. Compartment loading start and end times and dates should be included on the form.

The "Instructions to Captain" form letter will be prepared and signed. (See sample form in Appendix A.)

A PPQ Form 203 (for APHIS pre-inspected fruit) and a shipper's manifest containing the quantity and kind of commodity completes the documentation of each shipment. (See sample form in Appendix A.)

### Distribution of Documents

The original "Calibration of Temperature Sensors," "Location of Portable Sensors," a copy of the "Instructions to Captain," and the documents identifying the fruit will be placed in a sealed envelope and given to the captain for presentation to the clearance official at the port of destination. The original "Instructions to Captain" and one copy of the "Calibration" and "Location of Sensors" documents will be given to the Captain for his reference. Copies of all documents should be sent to OPPS and to the clearance official at the port of arrival.

### Container Vessel

During intransit cold treatment on container vessels, the containers of fruit are refrigerated using shipboard refrigeration equipment. The containers are placed in cells. Each cell is outfitted with a closed refrigeration system with air distribution ducts. Each container is individually connected to the air distribution ducts by pneumatically controlled retractable supply and return air couplings. The group of containers in any one cell (6 to 24) constitutes a unit shipment for intransit cold treatment clearance.

The temperature recorders are generally located in the control room. Each recorder has connecting cables which terminate at specific locations within the cell. For 40-foot containers, each container requires its own sensor. For 20-foot containers, if there are fewer than 5 containers in a cell, each requires its own sensor; if there are 5 or more containers in the cell, then 1 of every 2 containers will be equipped with a pulp temperature recording sensor.

When the containers have been positioned in the cell, the sensors are connected to the available cables. Temperature records from these containers are automatically recorded from this point to the time of discharge. In addition to the vessel's pulp recorder sensors, which are present in the containers, each container must be equipped with one

### Testing of Recorder Sensors at Shoreside

“Type T” thermocouple wire sensor. This wire sensor is inserted into the fruit during the loading of the container. Thermocouple wire sensors provide the means to measure fruit temperatures in each container by use of a compatible, portable temperature indicating instrument. Temperature measurements are made during the precooling period at the terminal and at the time of discharge.

Recorder sensors are tested under the monitoring of the designated certifying official using testing equipment equivalent to the recorders on board the vessel. The sensors are tested in a standard ice water bath at 0 °C (32 °F). Sensors may be tested at a central point prior to use provided the calibration errors are documented by the certifying official, and the sensors remain in the custody of the certifying official or person designated by that office.

### Testing of Temperature Recorders Aboard the Vessel

Prior to loading fruit, the temperature recording system is tested under the monitoring of the certifying official using resistor plugs of known calibration (0 °C) attached to the recorder’s connecting cables. Calibration error (which is the total of the combined error of the sensor and connecting cable) for each position on the recorder is documented by the certifying official.

### Fruit in Shipboard-Cooled Containers

The following instructions outline the standard operating procedures for the intransit movement of fruit in containers under USDA-APHIS intransit cold treatment regulations.

### Testing Recorder Sensors and Temperature Recorders

Officials approved by USDA-APHIS are the designated certifying officers (CO). The procedures for testing the temperature sensors and recorders are followed as outlined above under Container Vessel, Testing of Recorder Sensors at Shoreside and Testing of Temperature Recorders Aboard the Vessel.

### Loading of Containers

Each container is loaded under the direct monitoring of the CO. Specific standard fruit packages approved by USDA-APHIS are to be used in all containers.

Maximum loading temperature for pears and apples is 4.4 °C (40 °F). Standard stowage is used in all containers and only one type of fruit and one type of package.

Temperature sensors are inserted into fruit at predesignated positions by the CO in all containers.

A seal is applied by the CO following the completion of loading of each container. The seal number is documented by the CO.

### Precooling Fruit

Refrigeration is applied immediately upon the container’s arrival at the terminal.

Fruit is precooled at the terminal to 2.2 °C (36 °F) or below, prior to loading on the vessel.

Just prior to loading on the vessel, fruit pulp temperatures in containers are measured and documented.

### Stowing Containers on the Vessel

Containers are placed in the cells in a random fashion. At least one container equipped with a recorder sensor must be placed on each of the levels.

### Documentation by Certifying Officer

Documentation of containerized shipments are more extensive than the documentation that is normally associated with shipments in a conventional vessel. The following information is recorded for each container in the shipment:

- ◆ container identification number
- ◆ container seal number
- ◆ quantity of fruit in container
- ◆ type of fruit in container
- ◆ pulp temperature at loading fruit in container
- ◆ pulp temperature at placing of container on vessel
- ◆ container position in cell
- ◆ recorder sensor calibration
- ◆ recorder cable calibration
- ◆ total calibration correction
- ◆ sensor and cable
- ◆ recorder sensor position in container
- ◆ random temperatures sampled at dockside during loading

### Treatment

A continuous record of treatment temperatures is kept throughout the voyage. A responsible ship's officer must endorse the temperature chart during every 24-hour period. Treatment is not completed until so designated by a PPQ officer.

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## Clearance of Shipments Cold Treated in Transit

### Conventional Vessel

### Preliminary Planning

Prior to the arrival of the carrying vessel, the calibration and sensor location documents from the country of origin should have been received at the port of entry. Two additional copies are also placed on board the vessel, one of which is to be given to the PPQ officer.

A certificate of calibration is required for all shipments. This includes information as to the loading date and location of temperature sensors within the commodity, as well as calibration correction factors for every sensor.

The documents, and any accompanying correspondence, should be checked for comments relating to deficiencies noted at origin. They must bear the signature of a PPQ officer or of an authorized official of the exporting country. A list of such names and signatures for each country is on file at OPPS. The list of names and signatures by country is available upon request from OPPS.

Shipping line officials and pier supervisors should be informed of the quarantine safeguards to be observed pending clearance. The officer boarding the vessel should have several accurate thermometers. A scroll winding device should be used when reviewing records from a strip chart recorder.

The entries made on the intransit CT clearance report (PPQ Form 556) should be completed during the actual performance of each step of the clearance procedure. The instructions provide for a progressive clearance in the event that treatments are not completed before a vessel sails for a second U.S. port.

**Locate  
Responsible  
Ship's Officer**

**U.S. Vessel:** Usually the Chief Engineer or Reefer Engineer.

**Foreign Flag:** Usually the Chief Officer or Captain.

Inform the officer to withhold discharging the treated commodity until clearance has been completed.

Obtain the clearance officer's copy of the calibration documents from ship's officer (complete items 1-6, and 10).

**Determine  
Recorder Type**

**Vessel with Strip Chart Recorders:** Proceed to recorders with ship's officer. Determine if recorder is locked. Open recorder and check serial number (complete items 11 and 12).

Determine print interval by measuring time period, in seconds, between successive printing (complete item 13).

Stop recorder. Write name of vessel, date, time, and sign the temperature chart. Request ship's officer also to sign the chart. Remove the chart and restart the recorder.

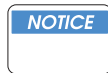
Return to quarters to review the temperature chart with the ship's officer.

Assemble the chart in scroll winding device. Using an appropriate section of the chart, calculate the chart speed (complete item 14).



To calculate chart speed, divide the print interval in seconds into 3600: divide answer obtained by the number of prints per 1 inch or 1 centimeter of chart; multiply answer by 24 to obtain inches or centimeters per day. A sufficient length of chart should be studied to obtain an accurate determination of the number of prints per inch or centimeter.

**Rewind the chart until the beginning of the chart roll is reached. Check the calibration record; compare actual calibration readings on the chart with the calibration data on the calibration document (complete item 23).**



When reading the recorded temperature values on the chart, use the calibration factor for each sensor. Check the sprocket holes for possible misalignment of the chart. From the start of the precooling period, mark the chart at regular intervals (i.e., every 24 inches or 144 cm) in numerical sequence so the actual length of the chart can be determined.

**Review the chart to the point where the loading of the compartment was completed. Determine the maximum and minimum fruit temperatures at the time when sensors were inserted (complete items 24, 25, and 26).**

**Continue reviewing the chart through the precooling period to the time when treatment commenced. Note abnormalities in the temperature readings which might indicate an irregularity in the treatment process (complete item 27).**

**Review the treatment portion of the chart for irregularities and excessive temperatures (complete item 28).**

**NOTICE**

If the initial treatment period is broken because of excessive temperatures, failure of the recorder, or improper procedure, and the treatment is later restarted, enter the date and time of restart on the second line of item 28. Air temperatures may occasionally exceed treatment temperatures during defrost cycles; however, fruit temperatures should not rise appreciably during this time. During non-defrost times, the temperatures of the air sensors should never exceed the maximum allowable treatment temperature. For each compartment of a hold, the hourly sensor printouts will be examined by a PPQ Officer at the port of entry. Based upon these records, the officer shall make a determination as to whether to accept the treatment as satisfactory. **In case of dispute, the ultimate decision shall be made by the Port Director**, who shall take all factors into consideration. Occasionally, for example, there are cases in which one or two sensors in a compartment mechanically malfunctioned during the voyage, due to factors beyond the ship's control (e.g., rough seas). This is generally excusable, as long as the other sensors in the same compartment showed no readings higher than the cold treatment schedule allows. If, however, the ship stopped at another port while in route to the discharge destination in the US, but failed to have the facility sensor(s) repaired and recalibrated, this may be considered negligence on the part of the shipping line. The fruit from such refrigerated compartments would have to be retreated (in a cold warehouse) to be eligible for entry.

If a sensor is reading consistently high, it should be tested by use of the ice-water bath technique. If this sensor proves to be accurate (i.e., readings within plus or minus 0.3C from zero, then it must be assumed that the high readings obtained in the fruit were indeed accurate, which would be sufficient grounds for rejection. For additional evidence, the officer may also obtain independent fruit pulp readings from a hand-held portable temperature-sensing instrument, in the area of the load where high readings were obtained from the ship's sensor(s).

**Compare actual chart length with calculated chart length. If not approximately the same, determine the cause and likely effects (complete items 15 and 16).**

**NOTICE**

To obtain actual chart length, multiply the last number in the numerical sequence by 24 inches or 144 cm. To obtain the calculated chart length, multiply the chart speed in item 14 by the actual number of days and fraction thereof from the start of precooling.

**Review the engineer's log for any irregularities which may have occurred during the treatment period. Proceed to refrigerated compartments with the ship's officer.**

**Check pulp temperatures with an accurate hand thermometer at high, low, and central areas (i.e., reefer door, hatch opening, fan room). Record maximum and minimum readings (complete item 29).**

**While taking hand thermometer temperatures, observe the stacking pattern (complete item 31). Return to the recording instrument and retrieve the remaining section of chart upon which the temperatures were being recorded during the clearance operation. These readings should approximate the readings taken with the hand thermometer. If**

## Vessel With Data Logger

not, determine the cause and likely effect on treatment (complete item 30). (Proceed to Clearance Action by Officer, Importation of Load and Compartments, and Distribution of Clearance Documents.)

Proceed to the data logger with the ship's officer. Request a temperature printout and observe performance of the instrument. Determine if the present time and date are correct (be sure to allow for time zone changes).

The vessel is permitted to store logged temperatures on magnetic media instead of printed on paper. However, the stored date must be printed in the presence of the PPQ Officer.

Collect all previous log sheets and return to quarters to review the temperature records with the ship's officer (complete items 11 and 13).

Assemble log sheets so that a review may be made starting at the beginning of the temperature record. Check the calibration record; compare the actual calibration readings on log sheets with the calibration data on the calibration document (complete item 23).



Many data logger installations are programmed to record temperature variations to one-hundredth of a degree centigrade (0.01 °C). With this high resolution of temperature readings, a deviation of up to three-hundredths of a degree can be expected from consecutive readings in a standard ice water test. Accordingly, calibration certifications which are acceptable under our accuracy requirements show either the average of two consecutive calibration readings or two consecutive readings which are within three-hundredths of a degree centigrade of each other. Deviations beyond this standard should be reported.

Review the log sheets to the point where the loading of the compartment was completed. Determine the maximum and minimum fruit temperature at the time the sensors were inserted (complete items 24, 25, and 26).

Continue reviewing the log sheets through the precooling period to the time when treatment commenced. Note abnormalities in the temperature readings which might indicate an irregularity in the treatment process (complete item 27).

Review the treatment portion of the log sheets for irregularities and excessive temperatures (complete item 28).



If the initial treatment period is broken because of excessive temperatures, failure of the data logger, or improper procedure, and the treatment is later restarted, enter the date and time of restart on the second line of item 28.

Air temperatures may occasionally exceed treatment temperatures during defrost cycles; however, fruit temperatures should not rise appreciably during this time, and should never exceed the maximum allowable treatment temperature.

Review the engineer's log for any irregularities which may have occurred during the treatment period. Proceed to refrigerated compartments with the ship's officer.

Check pulp temperatures with an accurate hand thermometer at high, low, and central areas (i.e., reefer door, hatch opening, fan room). Record maximum and minimum readings (complete item 29).

While taking hand thermometer temperatures, observe stacking pattern (complete item 31). Return to recording instrument to obtain printout of temperatures. These readings should approximate the readings taken with the hand thermometer. If not, determine the cause and likely effect on treatment (complete item 30). Proceed to the following: Clearance Action by Officer, Inspecting of Load and Compartments, and Distribution of Clearance Documents.

#### Clearance Action by Officer

The officer will: (1) record all exceptions in narrative form and attach to the clearance report; (2) release shipment for discharge if all requirements have been met and notify ship's officers, pier superintendents, and Customs; (3) hold shipment pending further evaluation if total effects of irregularities are not consistent with treatment requirements.

#### Inspection of Load and Compartments

Time permitting, a general examination should be made of the load and compartments during and after unloading is completed. Sensor locations, labeling, and physical condition should be observed and irregularities reported.

#### Distribution of Clearance Documents

See M390.210/556 for distribution information.

### Container Vessel

Prior to discharge, temperature charts are reviewed by the PPQ officer. The procedures for clearance of intransit cold treatment aboard container vessels are similar to general procedures outlined for conventional vessels in Intransit Cold Treatment—Ships, Clearance of Shipments Cold Treated in Transit, Conventional Vessel, except as noted herein.

Every container is equipped with one "Type T" thermocouple sensor which is inserted into the fruit during the loading of the container. These sensors provide the means for checking the fruit temperature during the clearance operation without having to open the container.

The standard procedure in making this temperature check is to proceed to the refrigerated hold with the ship's officer. The officer will: (1) locate the thermocouple wires which should be extending from each container, (2) record the number of the container, (3) attach the thermocouple wire to the potentiometer, and (4) record the temperature reading.

Manual pulp temperatures may be taken using an electronic, bimetal or liquid hand thermometer when necessary to check abnormal sensor readings.

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## Progressive Cold Treatment Clearance

Progressive clearance is a special procedure requiring advance authorization and planning before it can be accomplished. The OPPS is responsible for authorizing and coordinating progressive CT clearance.

When two ports are involved in the CT clearance of a vessel, the first port removes the initial portion of the temperature chart for review. Items 1 through 27 of PPQ Form 556 are completed. The first port must forward the removed portion of the temperature chart along with the Treatment Clearance Report (PPQ Form 556), with observations and comments attached, and calibration documents to the final clearance port. Discrepancies which are noted by the first port should be reported by phone (and recorded on the PPQ Form 556) to the second port in advance of the ship's arrival. All documents must be forwarded with the vessel under the Captain's care.

The second port, after reviewing the remainder of the treatment record, completes the PPQ Form 556 for distribution. The initial portion of the temperature chart need not be reviewed unless a discrepancy is noted.

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## Intransit Cold Treatment Procedure—Self-Refrigerated (Integral) Containers: Introduction

Self-refrigerated containers can be used successfully to satisfy cold treatment requirements; however, factors such as commodity type, packing, loading patterns, load, ambient temperature, container handling practices, and shipboard monitoring can affect the outcome of the treatment. All aspects of this type of cold treatment must be monitored very closely to insure success.

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## Initiating Intransit Cold Treatments

### Check Container

Type and series must be USDA-approved (see Appendix F).

The container must be sound, in good working order, and the doors must have a tight seal. Also must be precooled prior to loading. Precooling may be done in the container but must have prior approval from OPPS.

### Calibration of Temperature Recorders and Sensors

Recorder must be USDA-approved. See a list of approved temperature recording instruments in Appendix H, Temperature Recorders for Self-refrigerated Containers.

Calibration is conducted using a mixture of crushed ice and fresh water in clean, insulated containers. The ice must nearly fill the container; then water is added to the level of the ice. As the ice melts, additional ice is to be added or the water level reduced. The ice water mixture must be carefully prepared and maintained.

The sensors must be submerged in the ice water mixture without touching the sides or bottom of the container. It is important that the mixture be constantly stirred while testing. Testing of each sensor in the ice water must continue until the reading is stabilized at the lowest temperature obtainable. Two consecutive readings of the lowest temperature obtainable must be recorded. There should be at least a 60-second interval between the two consecutive readings for any one sensor; however, the interval should not exceed 5 minutes. Any sensor which records more than plus or minus 0.3°C (0.5°F) from the standard of 0°C (32°F) must be replaced. Every effort should be made to determine the calibrations to the nearest tenth of one degree. Also, the recorder used with the sensors must be capable of printing on demand and not just at hourly intervals.

### Check Fruit

Prior to loading, fruit should be precooled to a treatment temperature or to a uniform temperature not to exceed 4.5 °C.

Fruit temperature must be checked manually before loading, and the warmest fruit placed in the last quarter of the load.

Fruit must be loaded directly from the precooling storage area to the container so the fruit temperature does not rise.

### Loading the Fruit

Each container must contain only one type of fruit loaded in one type of carton. Fruit must be loaded so that the floor is completely covered, and the load is of uniform height throughout the container.

Bottom air delivery units must be loaded using “solid block” stowage. Top air delivery units must be loaded using “horizontal air flow” stowage.

A numbered seal must be placed on the loaded container. This must not be removed until the load has been cleared at the port of destination.

Fruit temperatures must not be allowed to rise after loading and during the transfer of the container to the vessel.

### Monitor Loading and Placement of Temperature Sensors

Records of temperature are required from at least three locations. One fruit sensor (previously called an air sensor) must be placed in the fruit in the top of the center box located at the front of the load next to the air return intake. If, for example, the fruit is grapes, this sensor would be placed in the cluster of grapes in the top layer of fruit in the top of the box. The two remaining fruit sensors must be placed approximately 5 feet from the end of the load for 40-ft containers and approximately 3 feet from the end of the load for 20-ft or 24-ft containers (see Figure 3.3.1 showing placement of sensors).

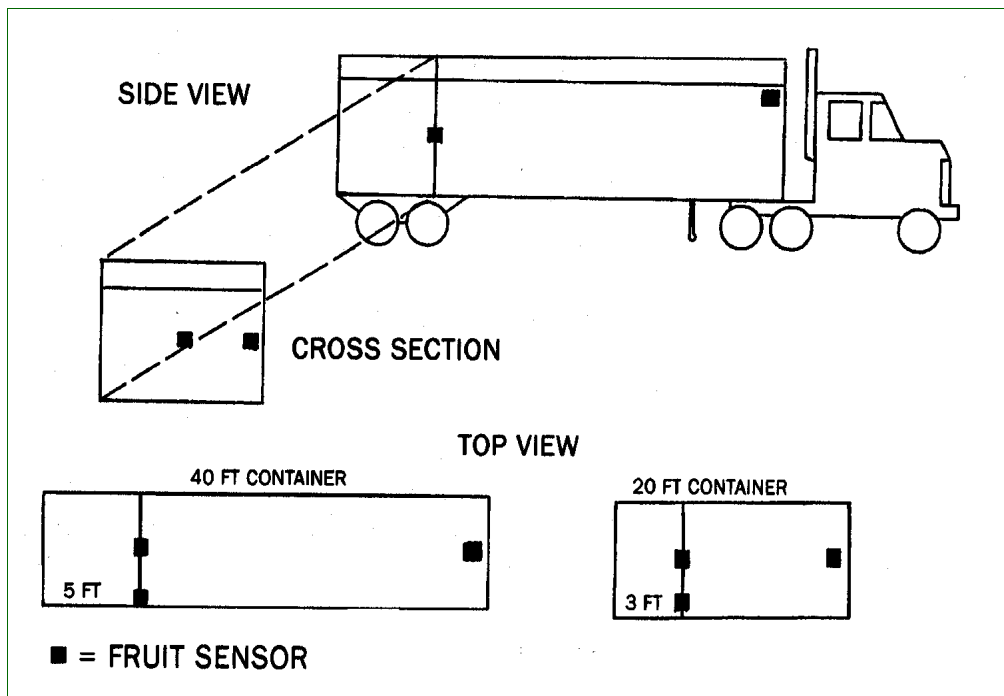


FIGURE 3-7-1: Position of Temperature Sensors in Containers

One sensor must be placed in a center carton and one in a carton at a side wall, both at one-half the height of the load. Placement of sensors must be under the direction of a PPQ officer or a certified official in the country of origin. The tip of the sensor must not extend beyond the fruit. With small fruit it may be necessary to penetrate two or more fruit.

If the recorder is to be carried inside of the container, the temperature data should be obtainable without opening the container doors.

Recordings of all temperature sensors must be made every hour, and printouts must be made available to the PPQ officer at the port of destination for final clearance of the container.

In addition to the recorder sensors in the container, each container should be equipped with a “Type T” thermocouple wire sensor. This wire sensor is inserted into the fruit near one of the recorder sensors.

The wire ends must be available on the outside of the container. The wire sensor provides the means to measure fruit temperature by use of a compatible, portable temperature-indicating instrument.

Off-loading of self-refrigerated containerized fruit that is under treatment must be accomplished rapidly. Containers must be off-loaded and treatment reconvened within 2 or 3 hours from the time the container was disconnected from the refrigerating unit. The pulp sensors should never exceed the maximum allowable treatment temperature.



The thermocouple requirement may be waived, with approval from OPPS; however, the container door must be opened and manual fruit pulp temperature must be taken after the cold treatment is complete.

### Prepare Documents

A “Certificate of Loading and Calibration for Cold Treatment in Self-Refrigerated Containers” document must be prepared for each container and signed by an approved official in the country of origin.

“Instructions to the Captain” and “Location of Temperature Sensors” documents must be prepared and signed. Only one of each of these is needed for each group of containers providing they are loaded in the same manner.

### Distribute Documents

The original “Calibration” document and a copy of the “Instructions to the Captain” document will be placed in a sealed envelope and given to the captain for presentation to the PPQ officer at the port of arrival.

The original “Instructions to the Captain” document and one copy of the “Calibration” document will be given to the captain for his reference. Copies of all documents must be sent to the PPQ officer at the first port of arrival and to the following address:

USDA-APHIS-PPQ-CPHST  
Treatment Support & Certification  
1017 Main Campus Drive, Suite 2500  
Raleigh, NC 27606  
Attention: Allison or Laura

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## Clearance of Intransit Cold Treatments

Obtain the temperature printout and match it with the corresponding “Certificate of Loading” and “Calibration” documents by using the container or recorder number. The documents, and any accompanying correspondence, should be checked for comments relating to deficiencies noted at origin. They must bear the signature of a PPQ officer or of an authorized official of the exporting country. A list of such names and signatures for each country should be on file at each approved port of entry, and signatures must be checked against this to verify authenticity. If the recorder has to be removed from the container to obtain the temperature printout, the recorder should be restarted and replaced as soon as possible so that the temperature record is not interrupted when additional time is needed for completion of the treatment. **This may only be done under USDA monitoring.**

Gaps in the print-out shall be allowed on a case-by-case basis, taking into account the number of gaps, length of each gap, and the temperature before and after. Gaps not exceeding one continuous hour in the print-out of a particular sensor are generally not considered significant, provided the temperatures were within range immediately before and immediately after the gap. Longer gaps in the print-out may be grounds for treatment failure, unless the crew has kept a detailed written log of hand-recorded pulp temperatures, all within acceptable range. In this case, a sworn statement from the ship's captain shall also be required.

Compare printout with loading document to be sure the calibration factors, recorder start time, and recorder start date are the same.

Using PPQ Form 556 (Intransit Cold Treatment Clearance Report) fill in items 1-6 and 10. Write the container number in item 24. Six containers can be cleared per form.

Record the maximum and minimum fruit temperatures from the printout at time of loading (complete items 25 and 26).

Review the temperatures and mark the printout where treatment commences at each temperature according to the appropriate treatment schedule. Determine date and time each treatment commenced (complete item 27).

Review the treatment portion of the printout for irregularities and excessive temperatures (complete item 28). Air temperatures may occasionally exceed treatment temperatures due to defrost cycles; however, fruit temperatures should not rise appreciably during this time. During non-defrost times the temperatures of the air sensors should never exceed the maximum allowable treatment temperature. If necessary, be sure to subtract or add correction factors to obtain the true temperature. (In some cases the computer used to download the data will perform this task.)



If the initial treatment period is broken because of excessive temperatures, failure of the data logger, or improper procedure, and the treatment is restarted, enter the date and time of restart on the second line of item 28.

After determining that cold treatment requirements have been satisfied, pulp temperatures of the fruit should be determined with an accurate hand thermometer (complete item 29) or by means of the thermocouple wire. In some cases this step can be performed when removing the recorder for downloading of data. Verification of the container seal number should also be done at this time.

Record the last readings of the printout in item 30. These readings should approximate the readings taken with the hand thermometer. Discrepancies should be further investigated.

If the treatment has not been completed, determine the amount of time needed to complete the treatment, and report this to the persons responsible for the container. At the end of the predicted completion period, check the temperature recordings to determine if the treatment has been completed.

Submit printout, copy of PPQ Form 556, and calibration documents to the OPPS. See M390.210/556 for distribution information. These documents should be submitted even if the treatment was negated.

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## Cold Treatment—Warehouses

### Requirements for the Movement of Enterable Fruit to Approved Cold Treatment Facilities

The warehouse must be approved by PPQ (see Certifying Facilities).

The shipment must move directly from the port of entry to the cold storage warehouse with no diversion or delay.

The warehouse must provide the necessary security for safeguarding each shipment.

The unloading of carriers which arrive at the warehouse under seal must be conducted under PPQ monitoring.

### Initiating the Cold Treatment

The procedures for the operational check of recording equipment and calibration of temperature sensors are similar to those outlined for vessels in Intransit Cold Treatment, Initiating Intransit Cold Treatments, Conventional Refrigerated Vessel, Check Instrument Operation and Calibrate Temperature Recording System. This must be performed under the direction of a PPQ officer.

Stowage must be arranged to provide for adequate air distribution throughout the shipment, and to allow for the sampling of pulp temperatures in any desired location. To accomplish this, aisles must be left between rows of pallets with the aisles parallel to the air flow. Space should also be allowed between pallets.

After loading is completed, manual fruit temperatures must be taken at various locations throughout the load to determine the location of the warmest fruit. Temperature sensors should then be placed randomly throughout the load, being sure to place sensors in the warmest areas. Under some conditions, additional air circulation will be required to cool the shipment uniformly. The use of additional fans or blowers will depend on the particular circumstances at the time of treatment.

Placement of sensors should be under the direction of a PPQ officer. The sensor must be well inserted into the fruit. The tip of the sensor must not extend beyond the fruit. If necessary (in the case of small fruit), the sensor should penetrate two or more fruit.

### Clearance of the Cold Treated Fruit

Clearance is similar to the procedure used to clear cold treated fruit on vessels (see Intransit Cold Treatment Procedure of Ships, Clearance of Shipments Cold Treated in Transit, Conventional Vessel).